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Analysis of Policies to Conserve Soil and Reduce Surplus Crop Production

ANALYSIS OF POLICIES TO CONSERVE SOIL AND REDUCE SURPLUS CROP PRODUCTION.
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ABSTRACT

Long-term acreage retirement and conservation-oriented commodity programs have potential for increasing soil conservation while reducing surplus crop production. Current commodity programs tend to discourage conservation. Retirement of land eroding at the highest rates would save the most soil but cost the Government more than other retirement options. Retirement of surplus crop acres targeted to highly erodible land could be cost-effective for both conservation and commodity program objectives. Cross-compliance would not promise widespread conservation benefits and might reduce commodity program effectiveness, but compliance incentives and modest changes in commodity programs could complement other soil protection measures.

Keywords: Acreage reduction, conservation reserve, cross-compliance, production adjustment, program consistency, soil conservation.

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PREFACE

Congress is considering new farm legislation to replace the expiring Agriculture and Food Act of 1981. The Department of Agriculture and many groups throughout the Nation have been studying the experience under the 1981 law and preceding legislation to see what lessons can be learned for the 1980's. The cost of traditional farm programs, their effectiveness in times of surplus, and their apparent inconsistency with soil conservation objectives are important issues in the current debate. This study analyzes various policies that would both conserve soil and reduce surplus crop production. It evaluates several long-term land retirement options and suggests ways in which commodity support programs could be administered to encourage conservation.

This report, prepared in the Natural Resource Economics Division, was coordinated by Anthony Grano and prepared by Neill Schaller, Richard Clark, Wen-Yuan Huang, Clayton Ogg, and Shwu-Eng Webb. For further information contact Anthony Grano at (202) 382-8000.

OTHER REPORTS ON FARM LEGISLATION

Other USDA reports providing background for 1985 farm bill discussions deal with the major program commodities, the farm industries that produce them, and the farm programs under which they are produced. These reports are available from EMS Information, rm. 0054 South Bldg., USDA, Washington, D.C. 20250; (202) 447-7255. They include Honey (AIB-465), Wool and Mohair (AIB-466), Wheat (AIB-467), Tobacco (AIB-468), Peanuts (AIB-469), Rice (AIB-470), Corn (AIB-471), Soybeans (AIB-472), Oats (AIB-473), Dairy (AIB-474), Sorghum (AIB-475), Cotton (AIB-476), Barley (AIB-477), and Sugar (AIB-478).

Background papers are also available on Federal Credit Programs for Agriculture (AIB-483), History of Agricultural Price Support and Adjustment Programs, 1933-84 (AIB-485), The Current Financial Condition of Farmers and Farm Lenders (AIB-490), A Summary Report on the Financial Condition of Family-size Commercial Farms (AIB-492), Foreign Exchange Constraints to Trade and Development (FAER-209), Financial Constraints to Trade and Growth: The World Debt Crisis and Its Aftermath (FAER-211), Possible Economic Consequences of Reverting to Permanent Legislation or Eliminating Price and Income Supports (AER-526), Do USDA Farm Program Participants Contribute to Soil Erosion? (AER-532), and the Impacts of Policy on U.S. Agricultural Trade (ERS Staff Report No. AGES840802).

CONTENTS

SUMMARY

Paying farmers to retire erodible land for 10 years could increase soil conservation while reducing surplus crop production, according to an analysis of representative retirement programs. Although current commodity programs tend to discourage conservation, it may be possible to save more soil by making modest program changes and providing incentives for conservation. Mandatory cross-compliance would not promise significant conservation benefits and might reduce commodity program effectiveness.

This report examines five long-term acreage retirement options in which landowners bid with USDA to put land into conserving uses for 10 years. The analysis of possible effects was limited to corn, soybeans, and wheat, three major program crops, and considered only water-caused erosion.

Three options emphasize reduction of crop output to a level preventing a buildup of commodity stocks:

- Retirement of Least Profitable Land currently used for program crops, without regard to cropland location or erodibility (option A).
- Retirement of Least Profitable Land in Line with Past Acreage Diversion (option B). This is the same as option A, but would maintain the traditional distribution of USDA program funds among regions.
- Retirement Targeted to Erodible Acres would first idle highly erodible land in program crops (eroding at 15 tons per acre or more), without regard to location of the land (option C).

Two conservation-oriented options would idle land without regard to its current use, location, or effect on output:

- A Conservation Reserve would idle all 22 million acres of highly erodible cropland (option D).
- A Conservation Reserve Retiring Worst Acres would idle 20 million acres with the highest erosion rates (option E).

The summary table compares the major effects of the five options.

The acreage retirement needed to achieve the desired output reduction ranged up to 26 million acres for option A, which idled the least profitable, and therefore the lowest yielding, land. Option B, concentrating retirement in the most productive regions, idled only 21 million acres. Option C idled a similar total acreage but took 13 million acres of highly erodible land out of production, compared to only 3 million for option B. Conservation reserve options D and E took out the largest production of corn and soybeans because of their erosivity, and the lowest output of wheat, which contributes less to water-caused erosion.

Among the three surplus reduction options, A-C, soil savings, compared to a base annual soil loss of 1.26 billion tons, ranged from 80 million tons under option B, which idled the least profitable land in line with past acreage diversion, to 267 million tons under targeting option C. Options D and E, emphasizing conservation, saved over 400 million tons of soil.

Estimated annual Government outlays for the surplus reduction options ran from a low of $840 million for option A, retirement of least profitable land, to $1 billion for option B, retirement in line with past diversion. Option C, retirement targeted to erodible acres, requiring an estimated outlay of $950 million, could be especially cost-effective in meeting the combined objectives of conservation and surplus reduction. The conservation reserve options, D and E, would cost the most in total, $1.3-1.4 billion, but their costs per ton of erosion reduction were the lowest of all options.

If current commodity programs were continued, a total annual crop diversion of up to 38 million acres could be required by 1990. Retiring 22 million of the 38 million surplus acres would reduce soil erosion by 289 million tons, compared to only 49 million tons if all 38 million acres were diverted annually. Moreover, retirement would reduce annual Government costs from an estimated $5 billion if all acres were diverted, to $2.9 billion.

Several approaches to saving more soil through changes in the implementation of present commodity programs were analyzed.

Denying farmers the benefits of commodity programs if they fail to practice conservation (mandatory cross-compliance) would likely improve program consistency more than it would increase conservation. Only 20 percent of U.S. farmers, on the average, participate in commodity programs, and less than one-half of those farmers have serious erosion problems. If farmers' costs of compliance exceeded the direct benefits of participating, participation in commodity programs could decrease, impairing attainment of commodity program objectives or raising Government costs to attract needed participation. The conservation leverage gained by cross-compliance would be lost in years when rising demand eliminated the need for commodity programs.

Paying additional benefits to farmers with severe erosion if they meet conservation standards could offset declining participation in commodity programs and reduce the financial burden of conservation borne by those farmers. A preliminary evaluation by the Economic Research Service of a USDA pilot Acreage Conservation Reserve program in 1984 showed that higher cost-sharing induced some farmers to retire more land. However, many were reluctant to commit land to grass for the required time because they feared loss of their official "base" acreages used to determine commodity program benefits, or had no way to make economic use of the forage.

Increased conservation benefits are possible without new laws or regulations governing commodity programs. Program improvements with potential for enhancing conservation include: stricter enforcement of groundcover requirements on set-aside and diverted acres; earlier announcement of annual commodity programs; more education of farmers on program requirements; more uniform Federal and State rules; and accelerated adoption of steps to tie crop insurance to soil productivity.

Summary table--Land use, soil erosion, production, and costs of long-term acreage retirement options

Item	Base	Reduction from base under: Option A	Option B	Option C	Option D	Option E
			Million acres			
Total cropland	353	26	21	22	22	20
			Million tons			
Soil erosion on total cropland	1,256	150	80	267	442	431
			Million acres			
Highly erodible land	22	6	3	13	22	20
			Million bushels			
Production of selected crops:						
Corn	7,984	402	402	402	617	581
Wheat	2,454	361	361	361	169	145
Soybeans	1,890	57	57	57	216	203
			Million dollars			
Annual Government cost (rental and establishment)	--	840	1,039	949	1,422	1,296
			Dollars			
Government cost per acre idled	--	33	49	43	64	65
Government cost per ton of soil saved	--	6	13	4	3	3

-- = Not applicable.

Analysis of Policies to Conserve Soil and Reduce Surplus Crop Production

INTRODUCTION

This report examines policy measures to conserve more soil on land used to produce crops supported by Government programs. It builds on an initial USDA study of the extent to which farm programs contribute to soil erosion (15).1/ Measures analyzed include long-term acreage retirement and conservation-oriented changes in the design and implementation of commodity programs.

Major crop surpluses, which disappeared with rising exports in 1970's, have since returned because of lagging exports and continued growth in the productivity of U.S. agriculture. No dramatic upturn in export demand is expected during the 1980's (7). These conditions could mean continued upward pressure on Government costs if traditional farm programs are used to deal with the resulting surpluses and low farm prices.

Public concern that traditional commodity programs may contribute to soil erosion adds another dimension to current discussion of farm policy alternatives. Rainfall-related soil erosion on U.S. cropland averages only 4.4 tons per acre per year, but exceeds 15 tons on 36 million acres (9 percent of cropland) (19). As a rule, soil can regenerate itself if annual erosion is not over 5 tons per acre (the tolerance or T level). Continued erosion can impair the soil's future productivity and cause off-site environmental damages such as sedimentation of streams and lakes, chemical runoff, and loss of fish and wildlife habitat.

Two factors explain soil erosion: the physical characteristics of the soil, such as its slope and the rainfall it receives, and use of the land. Row crops are more erosive than close-grown crops or pasture because they leave more land surface exposed to wind and water. Corn and cotton--the dominant row crops--are also "program" crops. That is, their prices are supported by USDA programs with price support and acreage set-aside or diversion provisions. Although there is no acreage diversion provision for soybeans, they are treated as a program crop in this report because of their substitutability with corn. Wheat, the other major program crop, is a close-grown crop and therefore less erosive. But production of wheat, especially in the West, normally leaves land exposed for part of the year, and for longer periods when the land is fallowed to restore soil moisture.

Commodity programs contribute to erosion by encouraging production of erosive crops. Wheat program incentives have been cited as a cause of sodbusting, the plowout of fragile grasslands in the Great Plains to produce wheat (6, 10, 22, 23).

1/ Underscored numbers in parentheses refer to citations in the References section.

What can be done to reduce or eliminate the inconsistency between commodity programs and soil conservation programs? Can commodity programs be designed to increase conservation, and conservation programs to reduce surplus crop production? Would redesigned programs reduce Government outlays?

A recent USDA study led by the Economic Research Service shows that reducing or eliminating the inconsistency between commodity programs and conservation would not, by itself, solve the erosion problem. Only one-fourth to one-half of U.S. cropland eroding above an annual average of 5 tons per acre (about 40 to 65 million acres) is operated by farmers who normally participate in USDA commodity programs, conservation (cost-share or technical assistance) programs, or both (8). So, no more than half of the excess cropland erosion could be "reached" directly by modifying USDA programs.

Nevertheless, concern over soil erosion has broadened public interest in ways to reduce whatever program inconsistencies might contribute to erosion and to increase conservation through the operation of commodity programs. Much of that interest now centers on acreage reduction schemes that would conserve soil while reducing the production of surplus crops.

Programs to support commodity prices typically require paying farmers to idle or divert some of the land they would otherwise use to produce those commodities. Annual diversions are costly. Government diversion and price deficiency payments averaged $104 per acre idled in 1977-82 (14). Payments were even higher under the 1983 Payment-in-Kind (PIK) program. Moreover, annual acreage diversions have not been overly effective in reducing soil erosion, for several reasons.

Farmers who participate in commodity programs requiring acreage diversion tend to idle their less profitable land. Soil erosion is only one reason for low profitability--and it is a major factor only when soil erosion reaches a yield-depressing stage. Crop yields on some erodible land actually exceed yields on much nonerodible land.

There is a lack of overlap between excess crop acres and erodible acres for individual crops (fig. 1). Less than 7 million wheat acres are highly erodible, considering only water-caused erosion. Yet, over three times that acreage would have to be set aside to avoid storage of more wheat. In contrast, while over 17 million acres of land in corn and soybeans have potential erosion of 15 tons per acre or more, only 6 million acres in these crops would have to be idled, assuming average yields, to effectively support their prices. Cotton appears to be the only exception: there is no noticeable difference between surplus acres and acreage affected by water-caused erosion.

No acreage diversion program exists for soybeans, an especially erosive crop. In 1977, soybeans were produced on nearly a third of the highly erodible acres used for surplus crops (1).

Finally, taking erodible land out of program crops on an annual basis does not, by itself, guarantee less soil erosion. Farmers are reluctant to make conservation investments on land idled for one year at a time. If the land is left bare for that reason, or if conservation is discouraged by late program announcements or uneven enforcement of groundcover requirements, soil erosion after idling can be worse than if the land had remained in production. This means that the Government pays twice. It pays farmers to take land out of production and again for technical and financial assistance to underwrite the conservation that does not accompany annual acreage diversion.

Long-term acreage retirement is an alternative to annual diversion. It has been tried before in response to the twin problems of soil erosion and surplus production. The Soil Bank, established by the Agricultural Act of 1956, paid farmers to retire land and shift it to conserving uses for up to 10 years under the program's conservation reserve component (20). Acres in the conservation reserve peaked at 28.6 million in 1960, then declined until 1972, when all contracts expired. Critics of the conservation reserve pointed to the disruption it caused by retiring substantial acreage in some communities (5). Conservation benefits were limited because the conservation reserve was open to any land, not just land with serious erosion. But program managers at that time did not have detailed nationwide erosion data of the kind now available to verify the erodibility of land offered for retirement.

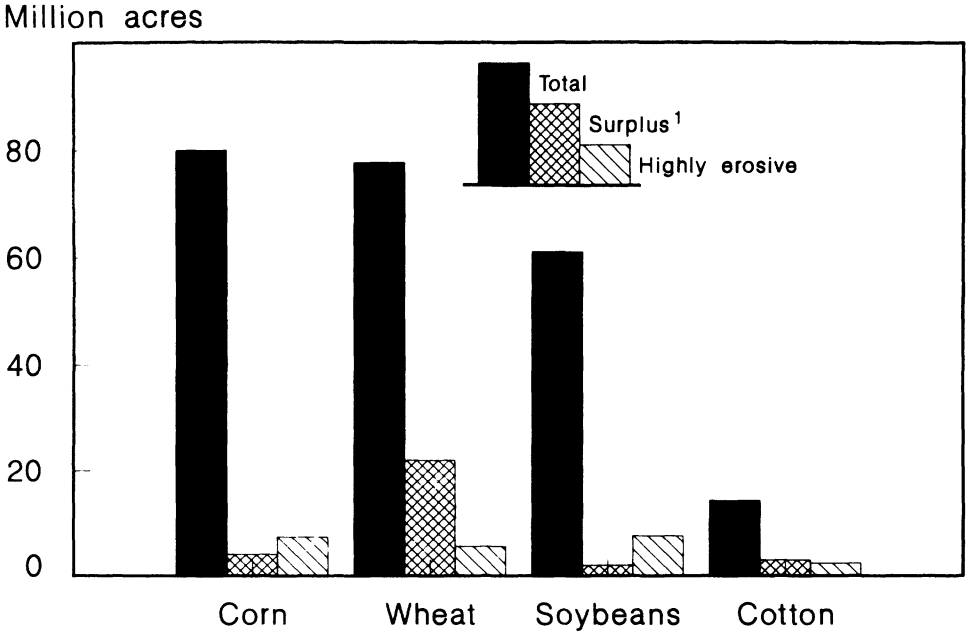
Long-term acreage retirement options are analyzed in the first part of this report. Two other policy approaches to reducing soil erosion are discussed in the final section: denying farmers the benefits of commodity programs if they do not practice conservation, or increasing program benefits if they do (called cross-compliance); and implementing commodity programs in ways that encourage soil-saving practices.

LONG-TERM ACREAGE RETIREMENT OPTIONS

We examined five long-term acreage retirement options. All are voluntary participation programs, requiring 10-year contracts with landowners. The options represent a continuum of program possibilities. They were chosen for analysis mainly to illustrate the complementarities and trade-offs between conservation and farm program objectives. However, options of the types examined are among those now mentioned for possible inclusion in the 1985 farm bill. The primary purpose of the first three is to reduce surplus crop production. The main purpose of the other two is to reduce soil erosion. Soil conservation may be

Figure 1

Comparison of total, surplus, and erodible acres in corn, wheat, soybeans, and cotton



1/ Acres that would have to be idled to support prices without a buildup of stocks.

enhanced by the former options, and surplus reduction by the latter. The question is, how much of each objective can be met, and at what cost to the Government?

Options Emphasizing Surplus Reduction

These three options represent different ways to reduce production of major program crops to the point where the remaining output would clear the market without a buildup of surplus stocks. The same quantity of each crop is removed under each option.

Option A. Retirement of Least Profitable Land

Under this option, farmers would receive an annual payment for 10 years to retire their least profitable land now used to produce program crops. As explained below, farmers would offer land for retirement through bids. In option A, their bids would be accepted from low to high, without regard to the erodibility or location of the land.

Option B. Retirement of Least Profitable Land in Line with Past Acreage Diversion

This is the same as option A, except that bids would be accepted so as to ensure a distribution of idled land comparable to that of past diversion programs. Option B is therefore more consistent with the traditional allocation of commodity program funds among producing regions. It would avoid marked acreage reductions in individual States or regions. To study the effects of this requirement, we specified that acreage cuts be proportional to those occurring in 1978, a recent and fairly typical year of significant diversion.

Option C. Retirement Targeted to Erodible Acres

Under this option, farmers would again bid their least profitable land, but bids for highly erodible land would be accepted first, and without regard to location of the land.

Options Emphasizing Conservation

The primary purpose of these two options would be erosion control rather than reduction of excess production. No minimum reduction in crop output is required.

Option D. Conservation Reserve

Farmers would bid only their highly erodible land in crops. The analysis of this option assumes that all such land would be offered for the reserve.

Option E. Conservation Reserve Retiring Worst Acres

Highly erodible land would again be offered, but with bids accepted in order of the land's erodibility, from high to low, until 20 million acres were retired.

Analysis of Options

We estimated the impacts of retirement options using extensive data from the 1977 National Resource Inventory (NRI) (19) of the Soil Conservation Service (SCS) and USDA's Resource Appraisal in 1980 (16), required under the Soil and

Water Resources Conservation Act of 1977 (RCA). A version of the national linear programming model developed at Iowa State University (3) for the RCA appraisal was used to capture the diversity of U.S. agriculture. The model delineates 105 producing areas, although most of the results reported here are aggregated to the national level. The model allows 10 crops and different methods of producing them to compete for available resources in each producing area, based on their relative profitability.

Our analysis of erosion impacts deals only with gross soil loss. It does not measure changes in crop yields or off-site environmental damages due to erosion. The analysis is limited to water-caused sheet and rill erosion. We were unable to consider the impact of wind erosion because wind erosion data in the 1977 NRI were incomplete.

To represent the continuum of land types with different yield-erosion attributes, we derived six land groups, based on data from the SCS land capability classification and the 1977 NRI, as explained in the Appendix:

Land group	Erosion potential	Yields
1	Low	Highest
2	Low	Low
3	Medium	High
4	High	Medium
5	High	Medium-low
6	High or low	Lowest

To simplify reporting, only results for the three major erosion categories are reported:

Erosion types	Land groups	Million acres in analysis
Nonerodible	1 and 2	171
Erodible	3	141
Highly erodible	4, 5, and 6	41
	Total	353

The highly erodible category consists of land with potential erosion of 15 tons per acre or more (see Appendix for further details). The 41 million acres of highly erodible land include 22 million acres in corn, soybeans, wheat, sorghum, barley, and oats, and 19 million in fallow, hay, and other uses. Land group 6 can be considered fragile land. The 11 million acres in this group have the lowest crop yields. While some of this land is not highly erodible, soil erosion for the group averages 12 tons per acre. SCS describes the land capability classes which make up group 6 as generally unsuitable for commercial crop production.

The 353-million-acre "base" for our analysis is lower than the more familiar base of 413 and 421 million acres of U.S. cropland, respectively, counted in the 1977 and 1982 NRI's. The difference is explained by our exclusion of special program crops such as peanuts and tobacco, fruits, vegetables; and other minor crops. Also, our "base" is an economic benchmark, assuming 1985 target prices for program crops, rather than an actual acreage inventory.

Cotton acres, although counted in the base, were excluded from the analysis of retirement options because erosion on land used to grow cotton is mainly caused by wind. Our analysis is limited to sheet and rill erosion. Less than 400,000

acres of the 16.6 million acres of cotton reported in the 1977 NRI had sheet and rill erosion of 15 tons per acre or more.

As noted above, options A through C included the requirement that production of each major program crop be reduced to the level where market prices on the remaining output would approach 1985 loan rates without a further buildup of stocks. Table 1 shows estimates of the production cutbacks that would meet this criterion, except for wheat.

The wheat production cutback of 11 million acres is only half of that required to meet price support objectives. The reason is that less than 7 million acres of wheat have significant sheet and rill erosion. Removing more than half of the surplus acreage would serve no purpose in reducing this erosion. To fully meet price support objectives, we assumed that 22 million acres of wheat would have to be idled.

Reducing wheat, corn, and soybean production to the desired levels would require retiring a total of 17 million acres, assuming 1977-81 average U.S. yields for these crops.

Several important assumptions were required for this analysis. We assumed that retired crop acres would be put into conserving uses, either permanent grass or trees. No harvesting of forage would be permitted. Acres not currently producing program crops could not be substituted for retired acreage. That is, no "slippage" would be permitted. Retirement contracts would include a release clause allowing the Secretary of Agriculture to return idled land to crop production when a supply shortage was anticipated. Contracts could also be signed for different time periods to prevent an abrupt rise in production when contracts expired. Further assumptions involved in the estimation of Government costs and soil loss are explained below.

Impacts

To assess the impact of long-term retirement options, we addressed three questions: What changes would occur in national and regional crop acreages and production as a result of long-term acreage retirement? How much would soil

Table 1--Output reductions required under options A, B, and C

Crop	Production reduction	Area diverted 1/
	Million bushels	Million acres
Wheat	361	11
Corn	402	4
Soybeans	57	2
Total		17

1/ Assumes 1977-81 average U.S. yields.

erosion be reduced? What would be the Government cost in total, per acre idled, per bushel reduced, and per ton of soil saved?

Land Use and Production

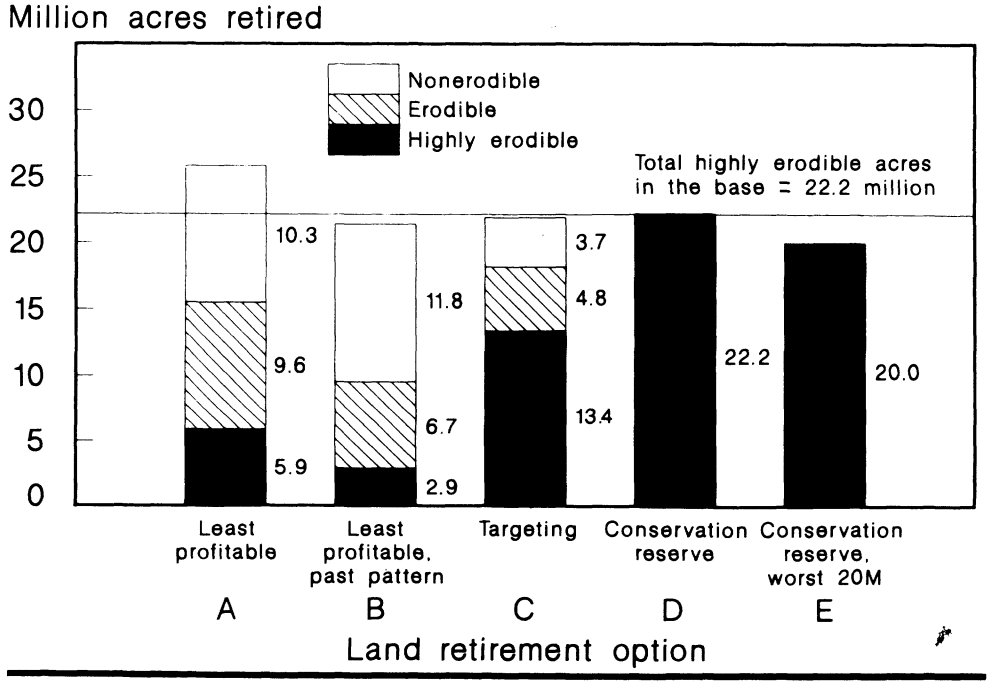
While the same quantity of surplus production was removed under options A through C, the total and individual crop acreage reductions varied by option (table 2 and fig. 2). Option A required retirement of more acres in total (26 million) than did options B and C. This is because option A took out land of the lowest profitability, with low per-acre yields. Option B, retirement in line with past diversion, idled only 21 million acres. Because past programs concentrated retirement in the most productive regions, fewer acres would have to be idled to meet the required production cutback.

Table 2--Total crop acreage reduction by land type, options A-E

Land type	Base acreage	Reduction under: Option A	Option B	Option C	Option D	Option E
		Million acres				
Nonerodible	170.6	10.3	11.8	3.7	0	0
Erodible	141.5	9.6	6.7	4.8	0	0
Highly erodible	41.1	5.9	2.9	13.4	22.2	20.0
Total	353.2	25.8	21.4	21.9	22.2	20.0

Figure 2

Acres of program crops retired by land type, 5 options



Option C, which targets the cutback to erodible land, retired about the same total acreage as option B. But the mix of land taken out and the regions affected differed substantially between the two options. The targeting option retired over 13 million acres of highly erodible land, compared with less than 6 million under option A (fig. 2). In contrast to retirement of least profitable land, option C took out all corn and soybeans on highly erodible land, and more of the wheat on such land (table 3). Option B would provide the least conservation. It idled only 3 million acres of highly erodible land.

The surplus corn acreage cutback in the Corn Belt increased substantially under targeting (option C) and the conservation-oriented options (table 4). Because corn is highly profitable in the Corn Belt, a much smaller acreage was retired from that region under options retiring the least profitable land. The reverse situation occurred in the Plains States. There, the tendency was to retire more cropland when the criterion was low profitability than when it was erodibility.

Because wheat is grown on relatively nonerodible land subject to sheet and rill erosion, a smaller acreage of wheat was idled by eliminating the requirement that wheat output be reduced by a specified amount. In contrast, the retired acreage of soybeans and corn was higher under options D and E than under options

Table 3--Acreage of program crops retired by land type, options A-E

Crop/land type	Base	Reduction under: Option A	Option B	Option C	Option D	Option E
		1,000 acres				
Corn:						
Nonerodible	54,018	3,467	2,390	0	0	0
Erodible	18,630	1,729	1,813	0	0	0
Highly erodible	7,411	1,936	972	5,277	7,412	6,930
Subtotal	80,059	7,132	4,796	5,277	7,412	6,930
Soybeans:						
Nonerodible	31,891	1,799	1,326	0	0	0
Erodible	21,741	309	327	0	0	0
Highly erodible	7,582	1,002	681	2,513	7,581	6,713
Subtotal	61,214	3,110	2,334	2,513	7,581	6,713
Wheat:						
Nonerodible	27,401	5,016	8,066	3,698	0	0
Erodible	44,744	7,534	4,586	4,786	0	0
Highly erodible	5,598	2,958	1,244	5,598	5,598	5,048
Subtotal	77,743	15,508	13,896	14,082	5,598	5,048
Total:						
Nonerodible	113,310	10,282	11,782	3,698	0	0
Erodible	85,115	9,572	6,726	4,786	0	0
Highly erodible	20,591	5,896	2,897	13,388	20,590	18,691
All	219,016	25,750	21,405	21,872	20,590	18,691

A through C, because corn and soybeans are relatively more erosive. The effect carried through to the output reductions under conservation reserve options. As shown in table 5, production cutbacks in both corn and soybeans were much larger than those required under options A through C, whereas the reduction in the output of wheat was less than half the amount required. The larger cutback in corn and soybean production under options D and E would be expected to raise

Table 4--Percentage reduction in acres of program crops by region, options A-E

Region	Option A	Option B	Option C	Option D	Option E
			Percent		
Northeast	0	1.2	1.0	3.3	3.6
Appalachian	1.8	1.5	5.9	7.9	8.7
Southeast	8.8	1.5	5.5	4.7	5.2
Delta States	3.0	.3	6.2	3.7	3.6
Corn Belt	12.7	15.5	23.3	60.8	58.1
Lake States	10.1	9.0	7.2	7.5	7.5
Northern Plains	18.5	38.3	27.2	7.4	8.1
Southern Plains	35.9	17.9	9.0	1.3	1.4
Mountain	6.2	12.2	11.2	1.2	1.3
Pacific	3.0	2.2	3.6	2.2	2.4
Total 1/	100.0	100.0	100.0	100.0	100.0

1/ Totals may not add to 100 percent because of rounding.

Table 5--Reductions in program crop output, options A-E

Crop	Base	Output reductions under: Option A-C	Option D	Option E
		Million bushels		
Corn	7,983.7	401.6	616.7	580.5
Wheat	2,453.3	360.8	168.9	145.1
Soybeans	1,889.5	56.6	215.9	202.7

their market prices above levels occurring under current acreage reduction programs. The higher prices, however, could stimulate increased production on farms not participating in the retirement program.

Soil Erosion

Initial soil erosion in our analysis totaled 1.256 billion tons. Because the analysis assumed a projected increase of 28 percent in cropland farmed using conservation tillage, the base level erosion and estimated soil savings averaged 25 percent less than actual sheet and rill erosion on cultivated land included in the study (19). Reductions in erosion from the 1.256-billion-ton base follow the acreage idling pattern (table 6). Option B reduced estimated soil erosion by only 79 million tons. Option A had a "soil savings" of 150 million tons. Option C resulted in a much larger reduction, 267 million tons. As expected, soil loss reductions under options D and E were substantially higher than under options A-C.

The estimated soil savings appear more significant if we consider only erosion above the tolerance level. For example, the 430 million tons of soil saved under option E would account for about 60 percent of the erosion over T on land included in the study (11).

Government Costs

To estimate Government costs of these acreage retirement options, we assumed that a "bid" system would be used to administer the program. Under such a system, farmers would submit bids to the Agricultural Stabilization and Conservation Service indicating the minimum payment they would be willing to accept to take a given acreage out of production. We used expected per-acre net returns to land and management from the model, adjusted in line with land rents actually paid by farmers, as estimates of the bids farmers would submit. The underlying assumptions were (1) that all farmers would submit bids, (2) that farmers' decisions on what to bid were made independently (there was no collusion), and (3) that land could be retired by land type even though different land may be represented within farmers' fields (14).

Table 6--Reduction in soil erosion from base erosion of 1.256 billion tons, options A-E

Option	Million tons	Tons per acre 1/
A Least profitable	150	5.82
B Least profitable, past pattern	79	3.70
C Targeting	267	12.19
D Conservation reserve	442	19.93
E Conservation reserve, worst acres	430	21.52

1/ Total tons of soil erosion reduced ÷ total acres idled (table 2). Tillage assumptions used in the analysis resulted in estimates of soil savings that average 25 percent less than would be indicated by data from the 1982 National Resource Inventory (19).

In addition to estimating costs using the bid system, we compared the bid and "offer" system costs for one option, retirement of least profitable land. Past long-term acreage reduction programs have typically used the offer approach in which farmers in a given area receive the same payment per acre idled. Under the offer system, farmers willing to retire land for less than the offer rate receive a windfall. Thus, the offer system is usually more expensive than the bid system, even if the costs of administering a bid system are higher.

Acreage rental payments are not the only costs of converting land from crops to conserving uses. The costs of establishing permanent grass cover or planting trees must also be borne by the farmer or government, whether Federal, State, or local. We incorporated these costs in our estimation of total outlays.

Rental Costs. The total annual rental costs to the Government of the three options emphasizing surplus reduction ranged from $697 million under option A to $942 million under option B (table 7). Options emphasizing conservation were far more costly--up to $1.3 billion for option D. The cost of option C was relatively low ($824 million), indicating the advantage of targeting acreage retirement. It ranked with option D and E when judged by its cost per ton of soil saved ($3.12) and its cost per bushel of surplus production reduced (table 8). This option could make a significant contribution in meeting both commodity and conservation objectives.

The benefits of retiring all or most of the highly erodible land seem to carry a high price tag. Option D would cost $56.56 per acre idled. However, the cost of this option per ton of soil saved ($2.14) was far lower than that for options aimed primarily at reducing surplus production.

The limited cost-effectiveness of past diversion programs for both conservation and surplus control is suggested by the results for option B. It not only cost more in total than all but the conservation options, but had a higher cost per acre idled than other surplus-reducing options. Its cost per ton of soil saved was higher than for any other option considered.

Table 7--Annual rental costs, options A-E

Option	Total cost	Cost per acre idled	Cost per ton of erosion reduced
	Million dollars	Dollars	
A (bid)	697	27.08	4.65
A (offer)	740	28.76	4.94
B	942	44.00	11.90
C	824	37.67	3.12
D	1,254	56.56	2.14
E	1,146	57.31	2.10

A comparison of Government costs using bid and offer systems, estimated only for option A, indicated that the offer system, as expected, would be more costly (table 7). However, the difference between bid and offer costs in actual experience could be less than shown because our estimation of bids assumed that all farmers would submit competitive bids.

Soil erosion reductions obtained for different Government outlays are shown in figure 3. If a retirement program were funded at less than $400 million a year, the targeting option (C) would yield the largest soil saving per dollar. For funding levels over $400 million, the conservation reserve option would be the most cost-effective in terms of erosion reduction. The least-profitable approach (A) would not compare favorably, except at funding levels below $100 million, illustrating again that the least profitable land is not necessarily the most erodible land.

Crop surplus reductions should be taken into account when comparing soil loss reductions at each cost level. Table 9 adds this information for Government rental costs of $200, $500, and $700 million. At the $200-million cost level, targeting acreage retirement was again the most efficient option. It reduced both soil erosion and surplus production of corn and soybeans more than the other options. This changed modestly at the $500 million funding level. Targeting still reduced corn and soybean output slightly more than the conservation reserve options, but did not result in as large a soil savings.

At the $700 million level, the conservation reserve option (D) provided the largest reduction in corn and soybean production as well as in erosion. But its advantage is misleading. The conservation reserve reduced production of these crops more than would be required to bring market prices in line with their 1985 loan rates.

Note that the least profitable option reduced wheat production more than any other option, at all three cost levels. This result was due to the lack of severe sheet and rill erosion on land used to grow wheat.

Table 8--Annual acreage retirement rental costs, per bushel of surplus production reduced, options A-E

Option	Corn	Wheat	Soybeans
	Dollars per bushel		
A (bid)	0.58	1.08	1.24
A (offer)	.62	1.16	1.31
B	.88	1.36	1.75
C	.89	1.06	1.56
D	.96	1.11	2.07
E	.96	1.09	2.08

Figure 3

Government rental cost of reducing soil erosion

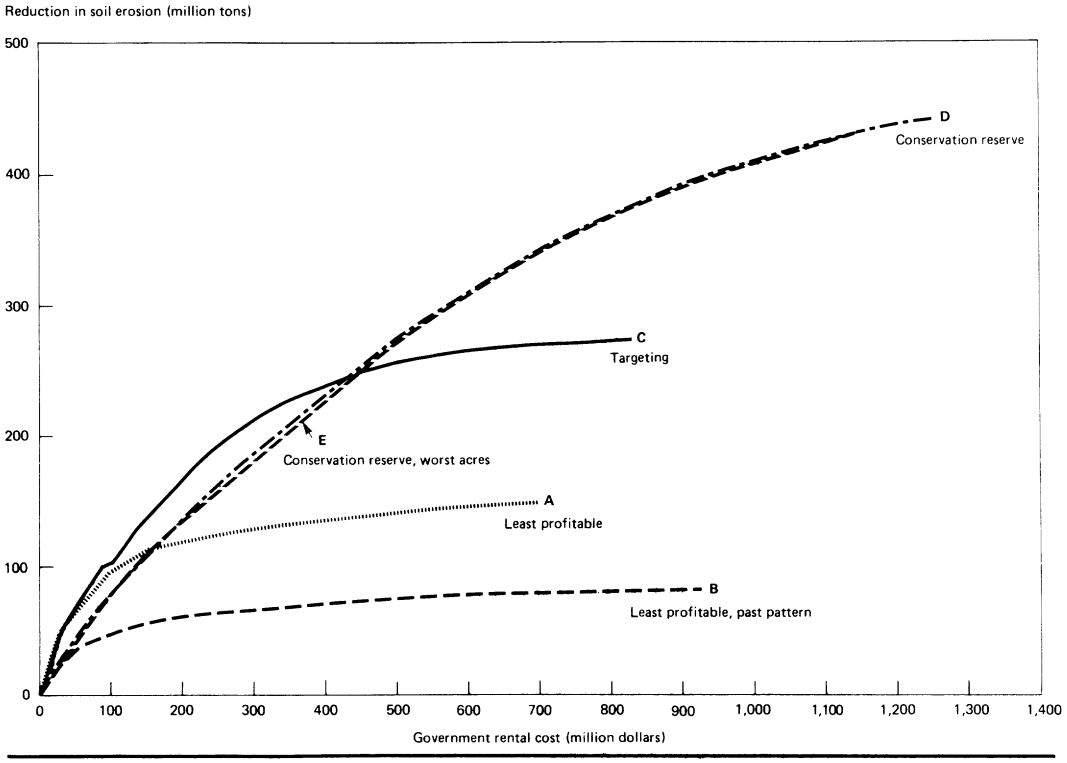


Table 9--Surplus and soil erosion reductions at different Government rental-cost levels

Cost level and option	Soil erosion reduction	Surplus reduction: Corn and soybeans	Surplus reduction: Wheat
	Million tons	Million bushels	
$200 million cost:			
A	119	165	92
B	62	177	27
C	168	270	24
D	139	121	12
E	137	119	12
$500 million cost:			
A	142	366	233
B	76	287	151
C	258	462	163
D	275	459	18
E	272	450	18
$700 million cost:			
A	150	462	361
B	80	363	237
C	272	463	283
D	344	605	28
E	341	598	26

Costs of Establishing Cover. Cover establishment costs vary widely with the type of cover and the area. In the South, tree planting costs less than establishing permanent grass. We estimated establishing costs on land retired under options A through E by multiplying the sum of average reported costs per acre in each of the 10 U.S. farm production regions, times the acres idled in those regions. The regional costs are shown in table 10. If establishment costs are covered entirely by the Government, with payment spread over a retirement contract life of 10 years, total Government costs would be as shown in table 11.

While questions of equity and funding are beyond the scope of this analysis, a few comments may be useful. We assumed that public funds would be required to reimburse farmers for income foregone on the land they idle and put into nonincome-generating conservation uses. Post-contract harvesting of forage or of trees may reduce the necessary annual rental payments incurred by Government. Funds to pay for acreage retirement could conceivably be provided by a Federal-State partnership, as well as by the Federal Government alone. For example, annual rental payments might be covered by the Federal Government and establishment costs by the States. An alternative might be Federal-State sharing of total costs based on criteria such as the State's current support for soil conservation.

Table 10--Costs for establishing permanent vegetative cover in the 10 U.S. farm production regions

Region	Cost per acre
	Dollars
Northeast	119
Appalachian	87
Southeast	100
Delta States	100
Corn Belt	86
Lake States	74
Northern Plains	20
Southern Plains	49
Mountain	24
Pacific	48
48 contiguous States	64

Source: (18).

Partial Substitution of Long-Term Acreage Retirement for Annual Diversion

By 1990, the continuation of current commodity programs could require diversion of up to 38 million acres of corn, wheat, and cotton to support their market prices without a buildup of stocks. Annual diversion costs by 1990 could average $129 per acre idled. As shown in table 11, the per-acre costs of long-term retirement are much lower, ranging from $33 under option A to $65 under option E. Thus, Government costs would decline if some of the land in surplus crops were retired rather than diverted.

Erosion would also be reduced more under long-term retirement. Soil savings under annual diversion would average 1.3 tons per acre, based on results of a USDA study of conservation effects of the 1983 PIK program (17). The 1.3-ton estimate was obtained by multiplying the acres of each program crop idled times the per-acre erosion reduction for that crop during the 1983 PIK program. In contrast, erosion would be reduced by 6 to 22 tons per acre if the land were idled under long-term retirement contracts, due to more adequate groundcover (table 6).

Therefore, as shown in table 12, substituting long-term acreage retirement for a portion of the land to be diverted would save both dollars and soil. We used option C (targeted retirement) for this illustration. If 22 million of the 38 million surplus acres were retired under option C, the erosion reduction would be 289 million tons, well above the 49-million-ton reduction expected if all surplus acres were idled under annual diversion programs. Government costs would be $2.1 billion (42 percent) less than the cost for diversion alone.

The advantages of combining retirement and diversion assume that "slippage" under the combination would be no greater than under current diversion programs.

Table 11--Government rental and annualized establishment costs, options A-E

Option	Annual rental cost	Annualized establishment cost	Total annual cost	Annual cost per acre idled	Annual cost per ton of erosion reduced
	Million dollars			Dollars	
A (bid)	697	143	840	33	6
A (offer)	740	143	883	34	6
B	942	97	1,039	49	13
C	824	125	949	43	4
D	1,256	166	1,422	64	3
E	1,146	150	1,296	65	3

Slippage occurs when farmers plant new land or fallow acres to offset the effects of acreage set-aside or diversion. These additional acres are then often added to the farmer's "base" acres for the relevant crop. Past expansion of the base acreage for wheat illustrates the slippage problem. The base increased from 46 million acres in 1970 to 91 million in 1984.

INCREASING CONSERVATION THROUGH COMMODITY PROGRAMS

If commodity programs are continued, so will the need and opportunity to increase conservation through their operation. Two possible ways to do so are through conservation cross-compliance and conservation-oriented improvements in the implementation of commodity programs.

Conservation Cross-Compliance

Cross-compliance proposals are of two kinds: Those requiring beneficiaries of farm programs to meet conservation standards (commonly called mandatory cross-compliance or the "red ticket" approach), and those that would increase program benefits to participants who meet conservation standards (the "green ticket" approach).

Table 12--Erosion reduction and Government costs under combined long-term acreage retirement and annual diversion, 1990

Item	Annual diversion	Combined diversion and long-term retirement	Advantage of combination
		Million acres	
Acres idled:			
Long-term 1/	0	22	
Diversion	38	16	
Total	38	38	
		Million tons	
Soil saved	49	289	+240
		Billion dollars	
Annual Government cost 2/	5.0	2.9	-2.1
		Dollars	
Annual Government cost per acre	129	76	-53

1/ Option C (targeting) was used here because it is efficient and idles acres of surplus crops in roughly the same proportion as 1990 projected acres in surplus.

2/ Diversion costs include both deficiency and acreage diversion payments (unpublished ASCS data). Long-term retirement costs include rental and establishment costs.

Most USDA programs already have some mandatory cross-compliance features. Commodity programs require adequate cover on set-aside and diverted acres. FmHA regulations encourage or require conservation activities on the part of their borrowers. The Federal Crop Insurance Corporation has the authority to deny insurance or charge higher premiums on highly erodible land.

Potential conservation benefits of mandatory cross-compliance are limited for several reasons:

- Commodity program participation and soil erosion do not overlap enough to promise significant soil savings. In its study of the consistency of USDA commodity and conservation programs, ERS found that an average of 20 percent of the Nation's farmers participate in commodity programs, but not also in conservation programs (8). Yet, less than one-half of these farms have serious erosion problems. A major reason for the limited overlapping of program participation and serious erosion is that there is no acreage diversion program for soybeans, a particularly erosive crop (13).

- Participation in commodity programs would be expected to decline if the farmer's costs of compliance exceeded the benefits of participation. Various studies have indicated that over time direct benefits to farmers from commodity program participation have been relatively modest (2, 4). The economic advantage of participating also depends on how successful the program is in stabilizing or raising market prices. If the program raises market prices, all farmers benefit regardless of participation (12). But as a rule, if farmers with high erosion rates incurring compliance costs above the direct benefits of commodity programs decide against participating, they will partly defeat the purpose of commodity programs.

- If mandatory cross-compliance lowered commodity program participation, USDA's ability to stabilize or support prices would also suffer. Paying higher benefits to offset declining participation not only would raise program costs but would provide windfall benefits to farmers for whom compliance would not be a problem.

- The soil conservation leverage gained by cross-compliance would be lost in years when rising demand eliminated the need for commodity programs. Yet that leverage is needed the most in times when the acreage of erosive crops is expanding.

While the "red ticket" approach has limitations for increasing conservation, it might improve program consistency. Imposing conservation requirements on commodity program participants would likely have the greatest impact on farmers in the Central and Southern High Plains, Western Corn Belt, and Columbia Plateau (9). Cash grain and cotton farmers would be among the producers most affected.

The "green ticket" approach--increasing price support or cost-sharing benefits to participants who meet conservation standards--would lessen the chances that farmers with erodible land would not participate due to high compliance costs. But the other factors limiting the effectiveness of cross-compliance would remain. Moreover, paying higher program benefits to farmers who conserve their soil would be a windfall to those who already practice conservation or for whom the costs of compliance are low.

Present programs contain elements of the "green ticket" approach in that cost-sharing is available for many practices used to meet conservation requirements. The "green ticket" approach was further tested by the USDA in 1984. Participants in commodity programs were given the opportunity to enroll in a special Acreage Conservation Reserve (ACR) program. Under this program, farmers could convert to conserving uses, for 5 to 10 years, cropland eroding at twice the tolerance rate in SCS land capability classes IIIe, IV, VI, or VII. The land had to be put under permanent grass cover or planted to trees. Participating farmers received 90 percent cost-sharing for establishing grass or trees.

A preliminary ERS evaluation of the ACR program showed the following:

- The 90-percent cost-share rate was an important attraction to many participants.

- Of the $20 million of available ACP funding for this pilot program, only $16 million were subscribed. Reasons included farmers' reluctance to commit their land for the required 5 to 10 years, concern that they would lose their crop acreage "base" by converting to permanent cover, late announcement of the program, changes in program rules during the signup period, and, in a few counties, noneligibility of certain grasses preferred by farmers as permanent cover.

- Conversion to grass was more acceptable to farmers with livestock because grazing was permitted after 6 months. Those farmers with no means of utilizing grassland were less likely to participate.

- Less than 1 percent of those enrolling chose to convert to trees. The attractiveness of this option for owners of erodible land was limited to a small region in the South.

- Because there is no diversion program for soybeans, farmers producing that crop could not enroll in the program.

Program Implementation

Past implementation of commodity programs has often overlooked soil erosion. Because soil conservation is now a high-priority goal of the USDA, the conservation consciousness of those who administer commodity and other programs in the field as well as in Washington is increasing.

Yet, more conservation could be achieved through those programs with no change in laws or regulations. For example, the 1983 PIK program required conservation and weed control on idled acres. The Department's preliminary evaluation report on conservation-use acres showed that erosion on idled land was indeed reduced under PIK (17). However, a more recent study by the USDA Office of Inspector General (OIG) indicates that larger conservation benefits were attainable (21). The OIG reported that 6 percent of the farmers in a 20-State sample did not fully comply with program requirements concerning soil protection and weed control. The reasons included lack of information on the requirements, uneven verification of the eligibility of conservation-use acres, and misapplication of conservation-use requirements to summer fallow land. Also, States and counties interpreted the guidelines differently. The Department's evaluation also found that live groundcover reduced soil loss more than crop residue. These results

point to a number of program implementation changes that could further reduce soil loss without hindering achievement of commodity policy objectives:

- Announce programs earlier. This would give farmers more time to consider the advantages and disadvantages of program provisions and to properly implement conservation measures.

- Increase education about, and enforcement of, program requirements and make guidelines at the State and national levels more uniform. Although flexibility needs to be maintained, too much flexibility can inadvertently reduce conservation.

- Accelerate adoption of insured unit crop yields for FCIC insurance. This change would tie insurance coverage to the productivity of the land and better reflect the risks of farming the more fragile and erodible soils.

- Permit farmers to graze diverted cropland, but in a nonerosive manner. This would give farmers some economic returns from idle land, easing their financial burden.

- In cases of abnormal weather conditions, permit flexibility in groundcover requirements consistent with soil conservation.

APPENDIX. LAND GROUPS DELINEATED FOR ANALYSIS

Several different soil classifications are now in use or proposed (1). The land groups in our classification were defined specifically to portray the most important combinations of erosion potential and crop yield levels. This enabled us to isolate the effects of land retirement strategies based on the erodibility versus the profitability of land. We developed six land groups by combining the SCS land capability class system with data from the 1977 NRI.

The land capability class system provides acreage and land use data for eight capability classes (I-VIII). These classes are further divided into subclasses if they have limitations for agricultural production. The subclasses are identified by the "dominant" limitation, such as erosion (denoted by e), wetness (w), and stony soils (s). Thus, the SCS system counts land as erodible only if erosion now limits agricultural production and if it is the dominant limitation. Data from the 1977 NRI show the effect. About 39 million acres of cropland in Land Classes II, III, and IV were eroding at 15 tons per acre or more. Yet erosion was considered the dominant limitation on only half of that acreage.

Using the universal soil-loss equation (USLE), the NRI gives us erosion data for sample points within classes and subclasses. The USLE singles out physical erodibility and the management factors which add to or retard actual erosion. The physical factors are R (rainfall), K (erosivity), L (slope length), and S (slope steepness). Numerical values for R, K, L, and S, when multiplied together, give an estimate of potential erosion. The management factors are C (crop grown and production technique) and P (conservation practices). The erosion rate is the product of RKLS and CP. CP values may range from 0 to 1. The maximum value for cropland estimated in the 1977 NRI was 0.7. The U.S. average was 0.3.

A RKLS of 50 is an important dividing line in our classification. Assuming an average CP of 0.3, an RKLS of 50 is equivalent to an erosion rate of 15 tons per acre.

Appendix table--Land capability class, erosion potential, and average U.S. corn yield, land groups 1-6

Land group	Land capability class 1/	Erosion potential	Average U.S. corn yield
			Bushels per acre 2/
1	I IIwa IIIwa	Low	109
2	IIw, IIs, IIc IIIw, IIIs, IIIc IVw, IVs, IVc V	Low	67
3	IIe IIIe IVe, RKLS less than 50	Medium	97
4	IIe and IIIe, RKLS over 50	High	85
5	IVe, RKLS over 50	High	79
6	VI VII VIII	High or low	37

1/ Suffix denotes dominant limitation. c = climatic; e = erosion; s = shallow, droughty, or stony soil; w = wetness; wa = wetness, but adequately treated.

2/ 1977 yields are shown here only to illustrate differences in productivity between land groups. U.S. average corn yield in 1977 was 102 bushels per acre.

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